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Impacts of nitrogen deposition on forest biogeochemical processes using across a trans-European gradient investigated using a tool kit of stable isotope methods.

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Meta-data analyses and the model based hypotheses state that global soil C storage is controlled by microbial scale processes of fungal competition for available nitrogen (N). Global trends of increasing atmospheric N deposition and the continuing use of inorganic N fertilizer in both agriculture and forestry mean that the soils vital function as a carbon sink is potentially under threat. We set out to experimentally investigate these hypotheses across a Trans-European gradient of forest soils and provide reliable information on soil microbial responses to nitrogen inputs for predictive climate change models.

Changes in soil nutrient status could result in a chain reaction of interacting microbial mechanisms which in turn could lead to the shifts in underlying ecosystem biogeochemical process rates. Recent meta-analysis has shown that plant fungal symbiont community structure, exerts a greater fundamental control over soil C storage than temperature, precipitation or net primary production. Based on the hypothesis that plant associated fungi effectively scavenge all available organic and inorganic N leaving little N for the growth of the free-living decomposer microbial community and preventing further breakdown of soil organic matter (SOM).

We have set up an experiment in which a series of dual isotope labelled C and N in-growth beech litter bags have been incubating in-situ in the forest. Moreover the treatment plots have received additional inputs of inorganic nitrogen fertilizer over an eight year period. We have studied both nitrogen and carbon dynamics in these systems using a tool box of stable isotope techniques.

We observed a slight decline in the 13C signature of the bulk soil in all treatments, implying mineralisation and loss of the carbon litter added.
Bulk pool analysis proved fairly insensitive. To tease out the dominant processes further specific isotopic analysis of more constrained soil C and N pools have been conducted: respired CO_2, microbial nitrogen and carbon, inorganic nitrogen, extracellular polymeric substances and permanganate oxidizable carbon. Results and conclusions will be presented.